

Exhibit 3

(Redacted)

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA
ALEXANDRIA DIVISION

UNITED STATES OF AMERICA, et al.,
Plaintiffs,

v.

GOOGLE, LLC,
Defendant.

Case No. 1:23-cv-00108 (LMB/JFA)

HON. LEONIE H. BRINKEMA

EXPERT REPORT OF JON WEISSMAN

July 7, 2025

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I. Assignment

1. In connection with the matter *United States of America et al., v. Google, LLC* (No. 1:23-cv-00108 (LMB/JFA)), I have been retained by the Antitrust Division of the United States Department of Justice (“Counsel”) to provide expert testimony in this matter regarding the technical aspects of Plaintiffs’ proposed remedies.

2. I have been asked to assess whether it is feasible, from a technical perspective, to copy and migrate certain technical assets, such as repositories of source code, configuration files, and data,¹ from Google’s Ad Exchange (“AdX”) and current publisher-ad server (“DFP”), including the final auction logic and remainder of DFP. I have been asked to assess the technical feasibility of developing or adapting application programming interfaces (“APIs”) that facilitate the proposed data sharing and interim remedies.

3. My assignment has three parts. First, I have been asked to determine whether it is feasible to identify the source code for AdX and DFP (including the final auction logic). Second, I have been asked to examine the feasibility of divesting AdX, and divesting DFP in stages, through open-sourcing the final auction logic, and later the remainder of DFP. Third, I have been asked to examine the process for creating APIs as proposed by Plaintiffs, in order to create a more open bidding process, and to share necessary data.²

4. My opinions are based on my analysis of publicly available material, Google source code and data, emails, sworn testimony, internal memos and documents, presentations, and other documents produced in this case, as well as my extensive research and experience in distributed systems, both in academia and industry, as of the filing of this report. A list of the materials I have relied upon is presented in Appendix A. If more information becomes available or I perform further analysis, I may modify or supplement my opinions.

5. I am being paid \$700 per hour for my time preparing this report and in preparation for and during deposition and testimony. I was supported by staff from Keystone Strategy, LLC. All the

¹ A full list of technical assets includes source code, configuration files, data, models, DevOps pipelines, CI/CD workflows, monitoring systems, alerting systems, test suites, and documentation.

² Plaintiffs’ Revised Notice of Proposed Remedies Sections I, II, and V, ECF No. 1482.

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opinions and conclusions stated in this report are my own. My compensation does not depend upon the outcome of this matter or the substance of any opinion I reach.

II. Qualifications

6. I have more than 25 years of academic and industry experience in computer science, with a particular emphasis on distributed and parallel computing, cloud and edge systems, large-scale workload scheduling, and data-intensive systems. Over the course of my career, I have contributed to the design, deployment, and performance analysis of numerous complex large-scale software systems. My research has resulted in over 100 peer-reviewed publications, many of which appear in leading technical conferences and journals. I currently co-chair the steering committee for the Association for Computing Machinery (ACM) Symposium on High Performance Parallel and Distributed Computing, which highlights innovations in distributed systems and cloud infrastructure. I have also served in editorial capacities for flagship journals, including the Institute of Electrical and Electronics Engineers (IEEE) Transactions on Parallel and Distributed Systems and IEEE Transactions on Computers.

7. I earned my Bachelor of Science degree in Computer Science from Carnegie Mellon University, followed by both a Master's and Ph.D. in Computer Science from the University of Virginia. During my doctoral studies, I created one of the earliest heterogeneous distributed computing systems that could automatically schedule applications across diverse computing resources, which was a foundational contribution to the field of distributed systems.

8. Currently, I serve as a professor in the Department of Computer Science and Engineering at the University of Minnesota, where I founded and now co-lead the Distributed Computing Systems Group, a research group that includes faculty members as well as undergraduate and graduate students. Our research focuses on advancing technologies in cloud and edge computing, data storage architectures, large-scale data-intensive systems, and scheduling algorithms for distributed environments.

9. Over the course of my career, I have been directly involved in designing and implementing seven major software systems, each addressing complex challenges in distributed computing. I began my career in the mid-1980s as a software engineer at Software Architecture and Engineering

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in Arlington, Virginia (later known as Template Software). There, I played a principal role in the Spectrum Project, a collaborative effort with Control Data Corporation. The Spectrum system was a large-scale, template-based framework developed to support the generation of knowledge-based information systems from high-level specifications and reusable templates.

10. As a technical software engineer at MITRE Corporation in McLean Virginia from 1989-1991, I developed large-scale parallel and distributed simulation software systems. I worked on two large-scale software systems: Moving Time Window (MTW), and Aggregate-Level Simulation Protocol (ALSP). ALSP was a software system that enabled disparate simulations to interoperate with one another. MTW was a parallel simulation framework that was developed to run on several classes of parallel computers. During my Ph.D. studies (1991-1995), I was a chief developer of the Legion meta-computing grid system (the pre-cursor to cloud computing) that was used by numerous national laboratories and companies.

11. In recent years, my research group has been actively developing and releasing several cutting-edge systems that address challenges in edge computing, cloud storage, data-intensive computing, and Internet of Things (“IoT”)³ management. One such project is DenseIoT, an operating system designed for controlling and managing IoT devices running disparate protocols produced by different vendors. DenseIoT leverages nearby edge computing and storage resources to efficiently process streaming IoT data. A common thread through my edge and cloud work is the use of multiple data centers and cloud providers for both computation and storage and enabling code to run code on disparate distributed platforms in general.

12. In addition to DenseIoT, my team has created Wiera, a geo-distributed cloud storage system; Nebula/Armada, a platform for deploying latency-sensitive services across edge-cloud environments; and Jingle, a system for dynamic resource management at the edge. We are currently developing a new multi-tiered edge-native storage system tailored to the needs of next-generation

³ Kinza Yasar and Alexander S. Gillis, “Definition: internet of things (IoT),” TechTarget, June 21, 2024, <https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT> (explaining that the “Internet of Things” is a network of devices equipped with technology to exchange data with each other and the cloud. A common example of this is “smart” household appliances but Internet of Things also extends to complex industrial uses.).

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IoT applications, such as autonomous vehicles. Both Wiera and Nebula have been open-sourced and made available to the broader research and development community.

13. I have taught undergraduate and graduate courses in operating systems, distributed systems, networking, and internet programming many times over my career and still do. In these courses, distributed resource management, cloud computing architectures, and system-level thinking are common themes. For my teaching in Operating Systems, the University of Minnesota awarded me the George W. Taylor/CSE Alumni Society Award for Distinguished Teaching in 2022.

III. Summary of Opinions

14. I understand that Plaintiffs have proposed a structural remedy pursuant to which Google would divest its ad exchange, AdX, and its publisher ad server, DFP (including its final auction logic).⁴

15. Based on my review of Google's internal documents and source code, and based on my expertise in data storage, distributed computing, resource management, cloud computing, and developing and testing large-scale software systems, it is my opinion that [REDACTED]

[REDACTED] Specifically, I offer the following opinions:

16. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

⁴ Plaintiffs' Revised Notice of Proposed Remedies Sections I and II, ECF No. 1482.

⁵ [REDACTED]
[REDACTED].

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about behavior and measure impacts in a low-risk way. To conduct these experiments, engineers “separate” a portion of traffic or a component and observe it under controlled conditions to test hypotheses without jeopardizing the entire production system.²¹²

130. As part of the migration process, engineers may also conduct dynamic dependency analyses to better understand the construction of the software system. Like the static dependency analyses, this type of analysis can also identify the external and internal dependencies of a system. Further, dynamic dependency analyses are also useful for assessing how the system’s dependencies impact performance and reliability. Real-time systems often interact with many components, including databases, caching services, user data services, and external partner APIs, and uncovering these dependencies and their behaviors is crucial for diagnosing issues and optimizing end-to-end performance. Some of these dependencies, including database, cache, or external API dependencies, can be easiest to detect at runtime, which requires dynamic dependency analysis. Dynamic analysis is also necessary for identifying how these dependencies behave when there is traffic flowing through the system and how the performance variability of components propagates through the larger system.

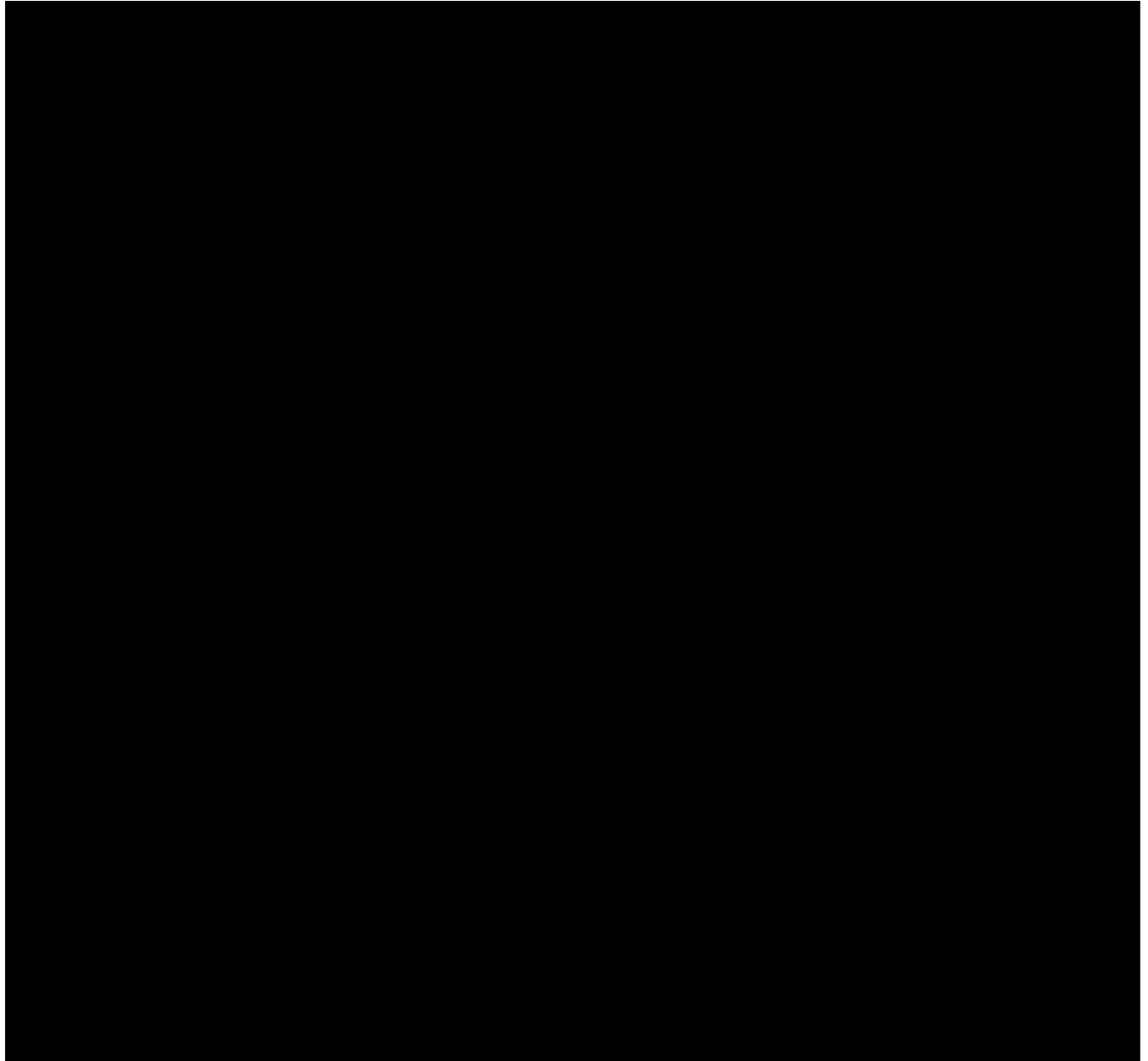
131. Dynamic dependency analysis complements static analysis by revealing hidden connections between software components that only appear when the system is running. It shows how long different parts of the system take to respond to each other, and it flags anything unusually slow that could impact how users experience the product. Static analysis uncovers direct links in the code, but there are issues it cannot identify. For example, static analysis cannot detect behavior that only appears when a feature flag—a switch that lets developers turn features on or off without redeploying—is enabled.²¹³ In addition, static analysis can’t uncover problems that only show up

²¹² See Florian Auer et al., “Controlled experimentation in continuous experimentation: Knowledge and challenges,” *Information and Software Technology* 134 (2021), <https://doi.org/10.1016/j.infsof.2021.106551> (surveying research on experiments in software engineering).

²¹³ See Radha Narayan et al., “Continuous Delivery,” in *Software Engineering at Google*, ed. Lisa Carey (Sebastopol, CA: O’Reilly, 2020), <https://abseil.io/resources/swe-book/html/ch24.html> (“A key to reliable continuous releases is to make sure engineers ‘flag guard’ all changes. As a product grows, there will be multiple features under various stages of development coexisting in a binary. Flag guarding can be used to control the

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when the system is under real-world traffic like slow response times or inefficient resource allocation. It also misses issues that happen only when tasks run at the same time, or when the system connects to outside services that are only used in specific situations, such as APIs called for certain groups of users.



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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134. After software engineers identify the source code and related systems for AdX, they will need to separate and migrate the AdX software into the acquirer's respective environment as part of the AdX divestiture.

135. To decouple AdX from the rest of Google's codebase engineers begin by performing a comprehensive inventory of the codebase. This inventory will (1) identify what code is AdX, (2) identify all points of integration between AdX and the rest of Google's codebase, and (3) identify all points of integration between to-be-divested components and Google shared systems, such as

[REDACTED].²¹⁴

136. I discuss the process of creating this inventory list and defining where decoupling could occur in Section VI. [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

²¹⁴ [REDACTED]
[REDACTED].

²¹⁵ [REDACTED]

²¹⁶ See "Protocol Buffers Documentation," Protocol Buffers, accessed July 1, 2025, <https://protobuf.dev/> ("Protocol buffers are Google's language-neutral, platform-neutral, extensible mechanism for serializing structured data.").

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[REDACTED]

139. Once the source code for AdX builds separately from Google’s codebase, engineers will deploy the AdX source code to a shadow environment within Google for testing. A **shadow environment** is a copy of the live environment, where new software can be deployed and tested in a setting that simulates real-world conditions, without impacting the live system (in this case Google’s current GAM offerings).²¹⁹ To simulate realistic usage, software engineers may copy a small portion of live traffic and send it to the shadow environment, where the new software runs. This shadow environment setup allows software engineers to observe how the new system performs compared to the current one, both in terms of functionality and latency. [REDACTED]

[REDACTED]

[REDACTED]

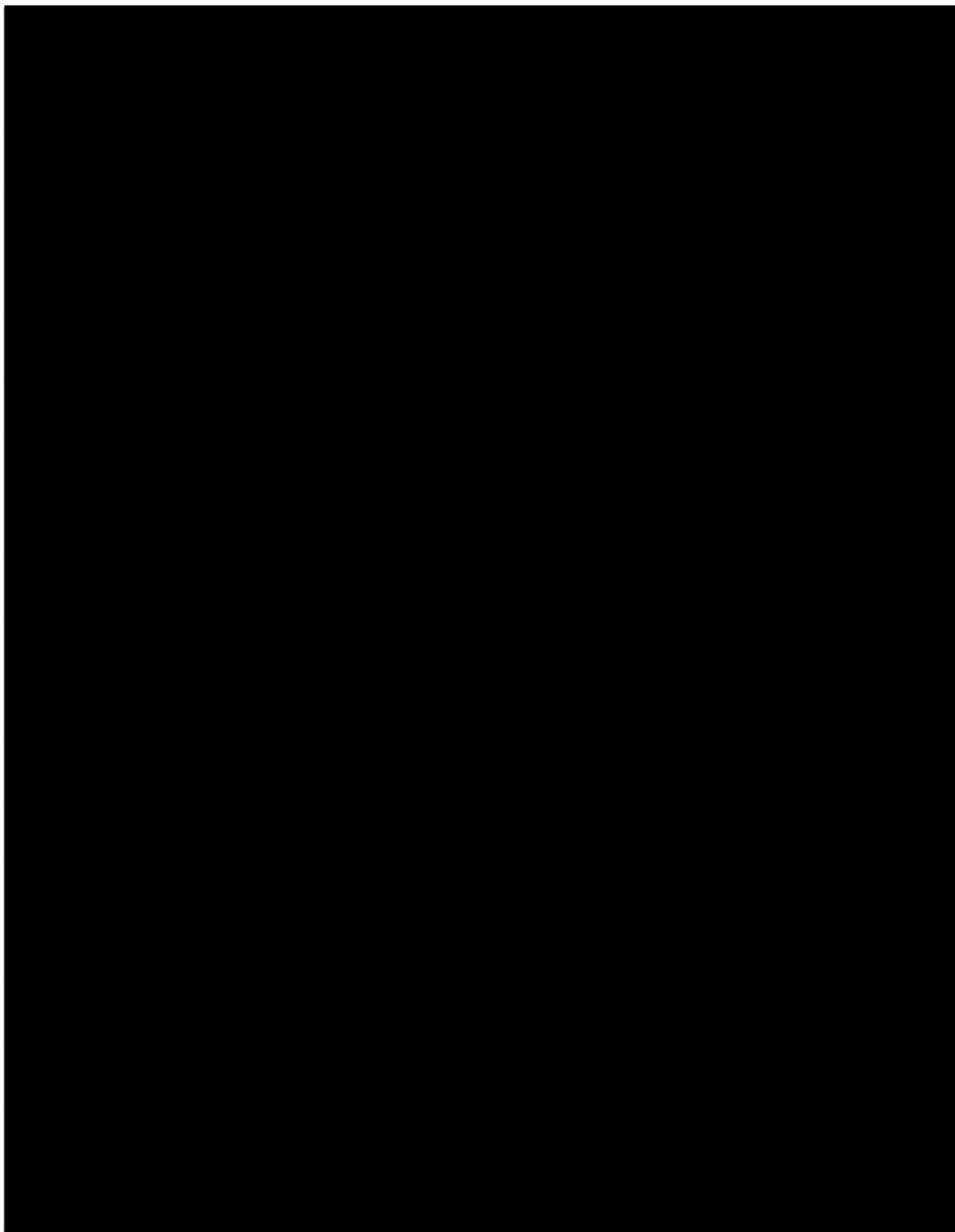
²¹⁷ Wrapping means adding a layer around systems calls so they go through a common interface. Stubbing means temporarily replacing those calls with simpler versions that don’t rely on the real system, often for testing and migration purposes.

²¹⁸ See, e.g., Giulio Astori, “Integrating Security DevOps Workflows with Microsoft Defender CSPM,” Microsoft, March 6, 2025, <https://techcommunity.microsoft.com/blog/microsoftdefendercloudblog/integrating-security-into-devops-workflows-with-microsoft-defender-cspm/4388094> (“Security Gates in CI/CD Pipelines: To prevent insecure deployments, Defender CSPM enforces security gates in DevOps workflows. If a high-risk vulnerability is detected during the build or deployment phase, the pipeline is halted until the issue is resolved, ensuring only secure code reaches production.”).

²¹⁹ See “Guidelines for developing high-quality, predictive ML solutions,” Google Cloud, last modified July 8, 2024, <https://cloud.google.com/architecture/guidelines-for-developing-high-quality-ml-solutions> (“Use shadow deployment when you deploy a new version of the training pipeline to the production environment. A shadow deployment helps you make sure that the newly deployed pipeline version is executed on live data in parallel to the previous pipeline version.”).

²²⁰ [REDACTED]

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Appendix B. Curriculum Vitae

JON B WEISSMAN

CURRICULUM VITAE

January 12, 2025

Work Address:

Department of Computer Science and Engineering
University of Minnesota
4-192 Keller Hall, 200 Union Street SE
Minneapolis, MN 55455-0159

Phone: (612) 626-0044
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Email: jon@cs.umn.edu
URL: <http://www.cs.umn.edu/~jon>

EDUCATION

Ph.D., Computer Science, University of Virginia, 1995.

M.S., Computer Science, University of Virginia, 1989.

B.S., Applied Mathematics and Computer Science, Carnegie-Mellon University, 1984.

PROFESSIONAL EXPERIENCE

Professor, Computer Science

Associate Professor, Computer Science

Visiting Researcher and Distinguished Visitor National e-Science Center, University of Edinburgh (2007-2008)

Assistant Professor, Computer Science

Univ. of Minnesota (1999-2003)

Assistant Professor, Computer Science

Univ. of Texas San Antonio (1995-1999)

Member of Technical Staff

Mitre Corporation, McLean Virginia (1989-1991)

Software Engineer

Software A&E, Arlington Virginia (1984-1987)

PROFESSIONAL ACTIVITIES

Tau Beta Engineering Honor Society, Member ACM, IEEE Senior Member

ACADEMIC AWARDS AND HONORS

- **George W. Taylor Distinguished Teaching Award** 2022.
- **Best paper nominee**, IEEE International Conference on Cloud Engineering (IC2E) 2015.
- **Best paper**, IEEE Grid conference, 2009.
- **Honorary Fellow**, College of Science and Engineering, University of Edinburgh, 2007-2008.
- **IEEE Senior Member**, promoted 2003.
- **Success Story**, ARL HPC (HPCMO), Virtual Data Grid Project, 2002.
- **CAREER Award**, National Science Foundation, 1996.
- **Supercomputing Award** for “High-Performance Computing with Legion”, SC, 1995.
- **Teaching Award**, University of Virginia Teaching Medal of Excellence, 1995.

CONSULTING HISTORY

- Cisco, Edge Computing, 2022.
- Instrumental Inc, Cloud computing, 2011.
- Beckman Coulter Inc, scheduling automation software, 2009-10.
- ApeniMED, health informatics software development, 2006.
- Avaki Inc. (now part of Oracle), Grid computing, 1999.

LEGAL SUPPORT EXPERIENCE

Testifying Expert

- MAYER BROWN LLP, MAXELL, LTD. v. SAMSUNG ELECTRONICS CO., LTD area: IoT and networking, project: patent analysis, expert and claim construction reports, represented: plaintiff, *deposition*, status: on-going, 2024, case: 5:23-00092 - EDTX.
- client: Fenwick & West LLP, R2 SOLUTIONS LLC v. DATABRICKS, INC., area: distributed data systems, project: patent analysis, expert and claim construction reports, represented: defense, status: on-going, 2024, case: 4:23-01147 - EDTX.
- Cooley LLP, SECTRA COMMUNICATIONS AB, COLUMBITECH INC., v. ABSOLUTE SOFTWARE, INC. and MOBILE SONIC, INC., area: network systems, project: patent analysis, expert reports, status: finished, 2023, case: 2:23-00353 - WDWA.
- client: Quinn Emmanuel LLC, case: SALESFORCE.COM, INC. v. WSOU INVESTMENTS, LLC D/B/A BRAZOS LICENSING AND DEVELOPMENT, area: Internet systems, project: patent analysis, expert reports, represented: defense, *deposition*, status: finished, 2023, case: 6:20-01172 - WDTX.
- client: Fisch Sigler LLP, case: Juniper Networks Inc. v. Swarm technology LLC, area: parallel processing, project: IPR declarations and ex-parte reexaminations, 4 *depositions*, represented: petitioner, status: finished, 2023, case: 3:20-03137 - NDCA.
- client: Quinn Emmanuel LLC, case: Juniper Networks Inc. v. WSOU INVESTMENTS, LLC D/B/A BRAZOS LICENSING AND DEVELOPMENT, area: networking, project: IPR, *deposition*, represented: petitioner, status: finished, 2023, case: 6:20-00812, 6:20-00813 - WDTX [IPR2021-00538].
- client: Klarquist, case: LS CLOUD STORAGE TECHNOLOGIES, LLC, INC., vs. Microsoft, area: data management, project: IPR declaration, represented: defense, status: finished, 2023, case: 6:22-00321 - WDTX.
- client: Skadden, Arps, Slate, Meagher & Flom LLP, and Keystone, case: Carbonite, Securities Class Action, area: backup/restore, project: testifying expert and report, represented: defense, *deposition*, status: finished, case: 1:19-11662 - D. MASS.
- client: Quinn Emanuel Urquhart & Sullivan UK LLP, Keystone, case: IBM UNITED KINGDOM LIMITED vs. LZLABS GmbH, WINSOPIA LIMITED, LZLABS UK LIMITED, Intellectual Property and license dispute, area: IBM mainframe runtime, project: patent analysis, represented: claimant, status: finished, case: [2022] EWHC (TCC) ENGLAND and WALES HIGH COURT.
- client: Quinn Emanuel Urquhart & Sullivan LLP, case: WSOU INVESTMENTS, LLC d/b/a BRAZOS LICENSING AND DEVELOPMENT, vs. SALESFORCE.COM, INC., area: Internet services, project: testifying expert and report, represented: defense, status: finished, case: 6:20-01166 - WDTX.
- client: Marton Ribera Schumann & Chang LLP, case: Zoho Corporation vs. BCS Software, LLC, area: file sharing, project: patent analysis, represented: defense, status: finished, case: 6:21-00051 - WDTX.
- client: Jones Day, case: Commvault v. Cohesity, area: data deduplication, project: patent analysis, represented: defense, status: finished, case: 1:20-00525 - D. DEL.

- client: DLA Piper LLP, case: Intellectual Ventures Co et al. v. Hewlett-packard, area: archival file systems, project: Ex-Parte Reexamination declaration, represented: defense, status: finished, 2021, case: 6:21-00226 - WDTX.
- client: ROPES & GRAY LLP, case: PALO ALTO NETWORKS, INC. v. CENTRIPETAL NETWORKS, INC., area: networking, project: IPR declaration, represented: petitioner, status: finished, 2021, case: IPR2021-01150.
- client: Quinn Emmanuel LLC, case: Juniper Networks Inc. v. WSOU INVESTMENTS, LLC D/B/A BRAZOS LICENSING AND DEVELOPMENT, area: networking, project: IPR declaration, *deposition*, represented: petitioner, status: finished, 2022, case: 6:20-00812 - WDTX.
- client: Unified Patents, LLC, area: virtualization, project: IPR declaration, represented: petitioner, status: finished, 2021.
- client: Klarquist, case: TERADATA US, INC., v. SAP SE, area: data management, represented: defense, status: finished, 2021, case: 3:18-03670 - NDCA.
- client: case: VEEAM SOFTWARE CORP., v. HYBIR INC., area: data backup, project: IPR declaration, *deposition*, represented: patent owner, status: finished, 2021, case: IPR2020-01037.
- client: Farella Braun + Martel LLP, case: Syncloud Technologies LLC vs. Adobe, area: storage, Web: IPR declaration + litigation, represented: petitioner, status: finished, 2021, case: 3:20-07760 - NDCA.
- client: Lee Sullivan Shea & Smith LLP and Orrick, case: Sonos vs. Google Inc., area: network audio, project: validity expert, represented: plaintiff, *claim construction deposition*, **testifying ITC court**, status: finished, 2021, case: 20-06754 - NDCA.
- client: Marton Ribera Schumann& Chang LLP, case: Zoho Corporation vs. Sentius International, LLC, area: web databases, project: patent analysis, expert reports, represented: defense, **claim construction tutorial to district court**, status: finished, 2021, 4:19-00001 - NDCA.
- client: Kilpatrick Townsend & Stockton LLP, FACEBOOK, INC. vs. BCS SOFTWARE, LLC, area: IT monitoring, project: IPR declaration, represented: petitioner, status: finished, 2020, case: IPR2021-00197.
- client: Fisch Sigler LLP, case: Packet Intelligence vs. Juniper Networks and Palo Alto Networks, area: networking, project: IPR declaration, represented: petitioner, status: finished, 2020, case: IPR2020-00336.
- client: DLA Piper LLP, case: TMI Solutions, LLC vs. CVS, Officemax, Home Depot Product Authority LLC, area: security, network services, project: IPR declaration, represented: petitioner, status: finished, 2020, case: 1:19-01230 - D. DEL.
- client: Reed Smith LLP, case: Uniloc vs. Paychex, area: distributed applications, project: prior art analysis, represented: defense, status: finished, 2020, case: 19-11272 - D. MASS.
- client: Orrick, case: SecureWave vs. Micron Technology, Inc., area: security, project: claim construction, represented defense, status: finished, 2019, case: 1:18-01398 - D. DEL.
- client: Fenwick & West LLP, case: PersonalWeb vs. Amazon, area: cloud, data storage, project: patent analysis, expert reports, represented: defense, status: finished, 2019, case: 18-00767, 18-05619 - NDCA.
- client: Jenner & Block LLP, case: Kove IO, Inc., vs. Amazon Web Service, area: cloud, data storage, project: patent analysis, IPR declaration, represented: defense, status: finished, case: 18-08175 - NDIL.
- client Cooley LLP, case: Zak Inc vs. Facebook, area: web, project: patent analysis, expert reports, represented: defense, status: finished, case: 4:15-13437 - EDML.
- client Cooley LLP, case: Blackberry Inc vs. Facebook, area: mobile computing, project: patent analysis, expert reports, *deposition*, represented: defense, status: finished, case: 2:18-01844 - CDCA.
- client: Faegre Baker Daniels LLP, case: ICN Acquisition, LLC vs. ipDataTel, LLC, area: home alarm systems and networks, IPR declarations, represented: petitioner, *deposition*, status: finished, 2019, case: 2:17-00608 - EDTX.

- client: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, case: KOM Software Inc. vs. NetApp, Inc. and HP, area: Distributed file systems, 5 IPR declaration, represented: petitioner, status: finished, 2019, case: 18-00160 - D. DEL.
- client: Cooley LLP, case: Vaporstream Inc vs. Snapchat Inc, area: mobile computing, project: patent analysis, expert reports, *deposition*, represented: defense, status: finished, 2018.
- client: Fenwick & West LLP, case: IBM vs. Groupon, area: security, web, client-server, project: patent analysis, expert reports, *deposition*, **testifying district court**, represented: defense, status: finished, 2017-2018.
- client: DLA Piper LLP, Workspot, Inc. vs. Citrix Systems, INC., area: security, IPR declaration, *deposition*, represented: petitioner, status: finished.
- client: Kekker, Van Nest & Peters LLP, BMC Software, INC., vs. Cherwell Software, LLC, area: software systems, IPR declaration, represented: petitioner, status: finished.
- client: Cooley LLP, case: Sound View Inc vs. Facebook, area: databases, web, project: patent analysis, expert reports, *deposition*, represented: defense, status: finished, 2018.
- client: Fenwick & West LLP, case: IBM vs. Groupon, area: security, IPR declaration, represented: patent owner, status: finished, 2017.
- client: Knobbe Martens, case: Ancora vs. HTC, area: security, CBM declaration, *deposition on claim construction 2019*, represented: petitioner, status: finished, 2017.
- client: Fisch Sigler LLP, case: Broadcom vs. Amazon, area: multimedia, IPR declarations, represented: petitioner, status: finished, 2017. No associated litigation.
- client: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, area: Internet applications, IPR declaration, represented: petitioner, status: finished, 2017. No associated litigation.
- client: McDonnell Boehnen Hulbert & Berghoff LLP, case: Trading Technologies Inc., area: distributed systems, project: Patent Examination, declaration, represented: patent owner, status: finished, **examiner interview**, 2016.
- client: Fenwick & West LLP, case: Actifio vs. Delphix, area: cloud storage, project: patent analysis, expert reports, represented: defense, status: finished (settled prior to trial), 2016.
- client: Fisch Sigler LLP, case: Kaavo vs. Amazon and Tier3, area: cloud computing, IPR declarations, *deposition*, represented: petitioner, status: finished, 2016.
- client: Morrison and Foerster LLP, case: Ancora vs. Apple Inc, area: security, CBM declaration, represented: petitioner, status: finished (settled prior to trial), 2016.
- client: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, area: mobile computer systems, 3 IPR declarations, represented: petitioner, status: finished, 2016. No associated litigation.
- client: Cooley LLP, case: BMC Inc vs. ServiceNow Inc, area: computer systems, project: patent analysis, expert reports, *deposition*, represented: defense, status: finished, 2016.
- client: Fish & Richardson P.C., case: Ericsson Inc vs. Apple Inc, area: mobile systems, project: patent analysis, represented: defense, status: finished, 2015.
- client: Morrison and Foerster LLP, case: Good Technology Inc vs. Airwatch Inc, area: mobile systems, project: patent analysis, 3 expert reports, *deposition*, represented: defense, status: finished, 2015.
- client: Troutman Sanders, Intellectual Ventures I LLC vs. Capitol One Financial Corp, claim construction declarations, area: mobile interfaces, represented: defense, status: finished, 2015.
- client: Bryan Cave LLP, case: Symantec vs. Veeam Software Corporation, area: storage systems, IPR declaration, *deposition*, represented: patent owner, status: finished, 2014.

- client: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, case: Clouding IP vs. Rackspace, area: storage systems, project: patent analysis, IPR and CBM declarations, *two depositions*, represented: petitioner, status: finished, 2014.
- client: Sidley Austin LLP, case: Motorola vs. Microsoft, area: mobile instant messaging, project: software patent analysis, expert reports, *deposition*, represented: defense, status: finished, 2011-2012.
- client: Baker & McKenzie LLP, case: WMR e-PIN vs. Wells Fargo, area: Internet e-commerce applications, project: software, patent analysis, expert reports, *deposition*, **testifying 3 judge panel**, represented: defense, status: finished, 2008-2009.

Consulting Expert

- client: William G. Osborne, Esq., Superior Edge vs. Monsanto, area: distributed software, project: code analysis, report, represented: plaintiff, status: finished, 2015.
- client: Arnold & Porter LLP, Rosebud v. Adobe, area: distributed software, project: patent analysis, represented: defense, status: finished, 2015.
- client: Jones Day, Summit 6 vs. Apple, area: web technologies, project: patent analysis, represented: defense, status: finished, 2014.
- client: Ropes & Gray LLP, case: Parallel Iron vs. EMC, area: storage systems, project: patent analysis, represented: defense, status: finished, 2012-2013.
- client: Bridges & Mavrakakis LLP, case: Nokia/HTC vs. Apple, area: operating systems, project: software, patent analysis, represented: defense, status: finished, 2011.

Professional references

- Jim Day (Farella Braun + Martel): <https://www.fbm.com/james-l-day>
- Andrew Mace (Cooley): www.cooley.com/people/andrew-mace
- Larissa Bifano (DLA Piper): www.dlapiper.com/en/us/people/b/bifano-larissa/
- Timothy Sullivan (Faegre Baker Daniels LLP): www.faegrebd.com/en/professionals/s/sullivan-timothy-m
- Phil Haack (Martin Ribera Schumann LLP): <https://www.martonribera.com/haack>
- Diek Van Nort (Morrison & Foerster LLP): www.mofo.com/people/v/van-nort-diek-o
- Joshua Goldberg (Finnegan LLP): <http://www.finnegan.com/>

MAJOR RESEARCH AFFILIATIONS

1. **Distributed Computing Systems Group, University of Minnesota, Founder and Co-Director.** The Distributed Computing Systems Group (DCSG) is collection of faculty and students working on topics in parallel and distributed computing, Internet/Web, mobile, cloud, edge, IoT, big data and machine learning. Cross-cutting topics include storage, networking, operating systems/middleware, security, and applications. Research centers on system building with a focus on resource management, efficiency, reliability, and enabling newly emerging applications.
2. **Digital Technology Center, University of Minnesota, Investigator.** The Digital Technology Center (DTC)'s goal is to create, promote, and coordinate cooperative interdisciplinary advanced technology initiatives between University, government, industry, and to serve as a point of entry into research and development partnerships with various partners. The DTC is a hub of innovation and excellence at the University of Minnesota in the digital technologies serving the industrial, educational, and public needs of the state of Minnesota and the nation. The DTC integrates research, education, and outreach in digital design, computer graphics and visualization, telecommunications, intelligent data storage and retrieval systems, multimedia, datamining, scientific computation, and other digital technologies. See dcsg.cs.umn.edu for details.
3. **CRIS:Center for Research in Intelligent Storage, University of Minnesota, Investigator.** The Center for Research in Intelligent Storage (CRIS) is a partnership between universities and industry, featuring high-quality, industrially relevant fundamental research, strong industrial support of collaboration in research and education, and direct transfer of university developed ideas, research results, and technology to U.S. industry. Research areas include storage and memory technologies, big data, cloud computing, backup/restore, data deduplication, and file systems. See cris.cs.umn.edu.

GRANT FUNDING

1. **Joint Principal Investigator**, Edge Computing, Cisco, 2022-2023, \$165K (with Chandra).
2. **Principal Investigator**, CNS Core: Small: Scaling the IoT with Constellation, NSF, 2019-2022, \$500K (PI Chandra).
3. **Co-Principal Investigator**, I/UCRC Phase II: Center on Intelligent Storage, NSF, 2016-2019, \$895,516 (PI Du, Co-PIs Chandra, Lilja, Mokbel).
4. **Co-Principal Investigator**, CSR: Small: Location, location, location (L3): Support for Geo-Centric Applications, NSF, 2016-2019, \$528K (PI Chandra).
5. **Co-Principal Investigator**, II-NEW: One Cloud Does Not Fit All: Minnesota Integrated cloud Systems research Testbed (MIST), NSF, 2013-2016, \$350K, (PI DU, co-PIs Chandra, Zhang).
6. **Principal Investigator**, An Integrated Middleware Framework to Enable Extreme Collaborative Science, DOE, 2012-2015, \$342K UMn share, collaborative with Rutgers and University of Chicago.
7. **Principal Investigator**, CSR: Medium: Enriching Mobile User Experience Through The Cloud, NSF, 2012-2015, \$700K (co-PI Chandra, Karypis).
8. **Principal Investigator**, DC: Small: One Thousand Points of Light: Accelerating Data-Intensive Applications By Proxy, NSF, 2009-2012, \$482K, including REU supplement \$36K (co-PI Chandra).
9. **Co-Investigator**, Collaborative Research: A Multi-University I/UCRC Center on Intelligent Storage, NSF, 2009-2014, \$400K, (DU PI, many co-PIs).
10. **Principal Investigator**, Grid Computing for E-Science, National E-Science Centre, University of Edinburgh, 2007-2008, \$52K.
11. **Co-Investigator**, ePCRN: Electronic Primary Care Research Network, NIH Roadmap, 2006-2008, \$50K (CSE share annual), (Peterson PI, Delaney PI, several co-investigators).
12. **Co-Principal Investigator**, ITR: A Data Mining and Exploration Middleware for Grid and Distributed Computing, NSF ITR, 2003-2007, \$1.5M, (Kumar PI, Weissman co-PI).
13. **Investigator**, Intelligent Storage Consortium, DTC, 2003-2009, \$250K (Du PI, Weissman, Lilja, Tewfik, Kim co-PIs).
14. **Investigator**, MRI: Development of a System for Interactive Analysis and Visualization of Multi-Terabyte Datasets, NSF MRI, 2004-2006, \$300K (Woodward PI).
15. **Contributor**, NIH NCRR, Intelligent Data Storage Support for Microarray data, equipment, (Mayo Clinic PI, with Du), 2004, \$222K.
16. **Co-Principal Investigator**, Intelligent Storage Consortium - Engenio, Engenio Information Technologies, 2004-2005, \$45K, (Du PI, Weissman co-PI).
17. **Principal Investigator**, Making Parallel Computing Easy, Department of Energy (Office of Advanced Scientific Computing Research), 2002-2007, \$250K, sole PI.
18. **Principal Investigator**, A Framework for Adaptive Grid Services, NSF ACR-CNS, 2003-2008, \$240K, sole PI.
19. **Principal Investigator**, Towards Community Services: Putting Parallel Network Services On-line, NSF EIA-NGS Program, 2002-2003, \$30K, sole PI.
20. **Co-Principal Investigator**, Collaborative Data Analysis and Visualization, NSF EIA Research Resources (Collaborative Research), 2002-2005, \$500K (incl. 2 RA's shared with Du), (Woodward PI, Weissman, Du, Retzel, Wetherby co-PIs.)

21. **Investigator**, Metacomputing: Enabling Technologies and the Virtual Data Grid, Army High Performance Computing and Research Center (AHPCRC), 2000-2004, \$260K, original contributor to center proposal.
22. **Principal Investigator**, Resource Management for Parallel and Distributed Systems, NSF CAREER award ACR, 1996-2001, \$200K, REU supplement \$5K (2000), sole PI.
23. **Principal Investigator**, Smart File Objects: An Application-directed File Access Paradigm, Texas Advanced Research Program ARP-010115-226, 1997-2000, \$106K, sole PI.
24. **Participant**, Telecommunication Networks for Mobile and Distributed Computing and Communications, AFOSR-F49620-96-1-0472, 1996-2000, \$2M, (PI Hiromoto).
25. **Co-Principal Investigator**, Building a Pipeline for Minority Scholars, NSF CISE MI-I CDA-9633299, 1996 - 1999, \$1.3M. (Hiromoto PI, Weissman, Das, Boppana, Psarris, Jeffery, Rosen co-PIs).
26. **Fellowship**, Applying Parallel Object-Oriented Computing to Scientific Applications, NASA Graduate Student Researchers Program Fellowship, Jet Propulsion Laboratory, 1991-1995, \$66K.

PUBLICATIONS

Journal Articles: for up-to-date-list, see www.cs.umn.edu/~jon

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2. Kwangsung Oh, Nan Qin, Abhishek Chandra, and **Jon Weissman**, Wiera: Policy-Driven Multi-Tiered Geo-Distributed Cloud Storage System, *IEEE Transactions on Parallel and Distributed Systems*, Vol. 31, No. 11, Feb 2020.
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6. Murray Cole, Shantenu Jha, Daniel S. Katz, Manish Parashar, Omer Rana, and **Jon B. Weissman**, Distributed Computing Practice for Large-Scale Science and Engineering Applications, *Concurrency: Practice and Experience*, Volume 25, Issue 11, September 2013.
7. Adam Barker, **Jon B. Weissman**, Jano van Hemert, Accelerating Service-Oriented Workflows, *IEEE Transactions on Services Computing*, 5(3), 2012.
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10. Jinoh Kim, Abhishek Chandra and **Jon B. Weissman**, Using Data Accessibility for Resource Selection in Large-scale Distributed Systems, *IEEE Transactions on Parallel and Distributed Systems*, 20(6), June 2009.
11. Byoung-Dai Lee, **Jon B. Weissman**, Young-Kwang Nam, Adaptive middleware supporting scalable performance for high-end network services, *Journal of Network and Computer Applications*, 32(3), May 2009.
12. Adam Barker, **Jon B. Weissman** and Jano van Hemert, The Circulate Architecture: Avoiding Workflow Bottlenecks Caused By Centralised Orchestration, *Journal of Cluster Computing*, 12(2), 2009.
13. Jason D. Sonnek, Abhishek Chandra, and **Jon B. Weissman**, Adaptive Reputation-Based Scheduling on Unreliable Distributed Infrastructures, *IEEE Transactions on Parallel and Distributed Systems*, 18(11), November 2007.
14. Darin England, Bharadwaj Veeravalli, and **Jon B. Weissman**, A Robust Spanning Tree Topology for Data Collection and Dissemination in Distributed Environments, *IEEE Transactions for Parallel and Distributed Systems*, 18(5), May 2007.
15. Rahul Trivedi, Abhishek Chandra, and **Jon B. Weissman**, Heterogeity-Aware Workload Distribution in Donation Based Grids, invited to the *International Journal for High Performance Computing and Applications* (IJHPCA), 20(4), 2006.
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17. **Jon B. Weissman**, Darin England, and Lakshman Abburi Rao, "Integrated Scheduling: The Best of Both Worlds," *Journal of Parallel and Distributed Computing*, 63(6), 2003.

18. **Jon B. Weissman** and Byoung-Dai Lee, "The Virtual Service Grid: An Architecture for Delivering High-End Network Services", *Concurrency: Practice and Experience*, Vol. 14, No. 4, April 2002.
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22. **Jon B. Weissman** "Gallop: The Benefits of Wide-Area Computing for Parallel Processing", *Journal of Parallel and Distributed Computing*, Vol. 54, No. 2, November 1998.
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24. Andrew S. Grimshaw, **Jon B. Weissman**, and W. Timothy Strayer, "Portable Run-time Support for Dynamic Object-Oriented Parallel Processing," *ACM Transactions on Computer Systems*, Vol. 14, No. 2, May 1996.
25. **Jon B. Weissman** and Andrew S. Grimshaw, "A Framework for Partitioning Parallel Computations in Heterogeneous Environments", *Concurrency: Practice and Experience*, Vol. 7, No. 5, August 1995.
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27. **Jon B. Weissman**, Andrew S. Grimshaw, and Robert R. Ferraro, "Parallel Object-Oriented Computation Applied to a Finite Element Problem," *Journal of Scientific Programming*, Vol. 2, No. 4, 1993.

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1. Benjamin Heintz, Abhishek Chandra and **Jon Weissman**, Cross-Phase Optimization in MapReduce, in Cloud Computing for Data-Intensive Applications, Springer, 2014.
2. **Jon B. Weissman** and Jinoh Kim, Network Awareness in Volunteer Networks, in Desktop Grid Computing, CRC Press, 2013.
3. Steve Chapin and **Jon B. Weissman**, Distributed and Multiprocessor Scheduling (Operating Systems Area), The Computer Science and Engineering Handbook, 2004.

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2. Yixuan Wang, Abhishek Chandra, and **Jon Weissman**, SQuBA: Social Quorum Based Access Control for Open IoT Environments, *IEEE Edge*, 2023, best student paper awardee.
3. Lei Huang, Zhiying Liang, Nikhil Sreekumar, Sumanth Kaushik Vishwanath, Cody Perakslis, Abhishek Chandra, and **Jon Weissman**, Armada: A Robust Latency-Sensitive Edge Cloud in Heterogeneous Edge-Dense Environments, *42nd IEEE International Conference on Distributed Computing Systems (ICDCS)*, 2022.
4. Kwangsung Oh, Abhishek Chandra, and **Jon Weissman**, A Network Cost-aware Geo-distributed Data Analytics System *20th IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid)*, 2021.
5. Albert Jonathan, Abhishek Chandra, and **Jon Weissman**, Wide-area Adaptive Stream Processing *ACM Middleware*, 2020.
6. Nikhil Sreekumar, Abhishek Chandra, and **Jon Weissman**, Towards a Robust Edge-Native Storage System *Fifth ACM/IEEE Symposium on Edge Computing (SEC)*, 2020.
7. Zach Leidall, Abhishek Chandra, **Jon Weissman**, An Edge-based Framework for Cooperation in Internet of Things Applications, 2nd USENIX Workshop on Hot Topics in Edge Computing (HotEdge), Renton, Washington, July 2019.
8. Albert Jonathan, Abhishek Chandra, and **Jon Weissman**, Multi-Query Optimization in Wide-Area Streaming Analytics, *ACM Symposium on Cloud Computing 2018 (SOCC)*, Carlsbad, California, October 2018.
9. Feng Liu, Kate Keahey, Pierre Riteau, and **Jon Weissman**, Dynamically Negotiating Capacity between On-Demand and Batch Clusters, *International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'18)*, Nov 2018, Dallas, TX.
10. Albert Jonathan, Abhishek Chandra, and **Jon B. Weissman**, Rethinking Adaptability in Wide-Area Stream Processing Systems, *Workshop on Hot Topics in Cloud Computing (HotCloud '18)*, June 2018.
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12. Kwangsung Oh, Abhishek Chandra, and **Jon Weissman**, Wiera: Towards Flexible Multi-Tiered Geo-Distributed Cloud Storage Instances, *25th IEEE International Symposium on High Performance Distributed Computing (HPDC)*, June 2016, Kyoto, Japan.
13. Matteo Turilli, Feng Liu, Zhao Zhang, Andre Merzky, Michael Wilde, **Jon Weissman**, Daniel S. Katz, and Shantenu Jha, Integrating Abstractions to Enhance the Execution of Distributed Applications, *30th IEEE International Parallel & Distributed Processing Symposium (IPDPS)*, May 2016, Chicago, IL.
14. Albert Jonathan, Abhishek Chandra, and **Jon Weissman**, Awan: Locality-aware Resource Manager for Geo-distributed Data-intensive Applications, *IEEE International Conference on Cloud Engineering*, April 2016, Berlin, Germany.
15. Francis Liu and **Jon Weissman**, Elastic Job Bundling: An Adaptive Resource Request Strategy for Large-Scale Parallel Applications, to appear in the *International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'15)*, Nov 2015, Austin, TX.
16. John Kolb, Prashant Chaudhary, Alexander Schillinger, Abhishek Chandra and **Jon Weissman**, Cloud-Based, User-Centric Mobile Application, *IEEE International Conference on Cloud Engineering*, March 2015, Tempe, AZ.
17. Ajaykrishna Raghavan, Abhishek Chandra, and **Jon B. Weissman**, Tiera: Towards Flexible Multi-Tiered Cloud Storage Instances, *ACM Middleware*, 2014.

18. John Kolb, Will Myott, Thao Nguyen, Abhishek Chandra and **Jon B. Weissman**, Exploiting User Interest in Data-Driven Cloud-based Mobile Optimization, *IEEE Conference on Mobile Cloud Computing*, April 2014, Oxford, UK
19. Mathew Ryden, Kwangsung Oh, Abhishek Chandra and **Jon B. Weissman**, Nebula: Distributed Edge Cloud for Data Intensive Computing, *IEEE International Conference on Cloud Engineering*, March 2014, Boston, MA
20. Abhishek Chandra, **Jon Weissman**, and Benjamin Heintz Decentralized Edge Clouds, *IEEE Internet Computing*, 2013.
21. Benjamin Heintz, Chenyu Wang, Abhishek Chandra, and **Jon B. Weissman**, Cross-Phase Optimization in MapReduce, *IEEE International Conference on Cloud Engineering*, March 2013, San Francisco, CA
22. Chonglei Mei, Daniel Taylor, Chenyu Wang, Abhishek Chandra, and **Jon B. Weissman**, Sharing-aware Cloud-based Mobile Outsourcing *IEEE 5th International Conference on Cloud Computing*, 2012.
23. Atul Katiyar and **Jon B. Weissman**, ViDeDup: An Application-Aware Framework for Video De-duplication, *Third Usenix Workshop on Hot Topics in Storage and File Systems* (HotStorage'11), Portland, OR 2011.
24. Louis-Claude Canon, Emmanuel Jeannot, and **Jon B. Weissman**, A Scheduling and Certification Algorithm for Defeating Collusion in Desktop Grids, *31st IEEE International Conference on Distributed Computing Systems* (ICDCS), Minneapolis, MN, June 2011.
25. Louis-Claude Canon, Emmanuel Jeannot, and **Jon B. Weissman**, A Dynamic Approach for Characterizing Collusion in Desktop Grids, *24th IEEE International Parallel and Distributed Processing Symposium* (IPDPS), 2010.
26. Abhishek Chandra and **Jon B. Weissman**, Nebulas: Using Distributed Voluntary Resources to Build Clouds, *Workshop on Hot Topics in Cloud Computing* (HotCloud '09), June 2009.
27. **Jon B. Weissman** and Siddharth Ramakrishnan, Using Proxies to Accelerate Cloud Applications, *Workshop on Hot Topics in Cloud Computing* (HotCloud '09), June 2009.
28. Adam Barker, **Jon B. Weissman** and Jano van Hemert, Eliminating the Middle-Man: Peer-to-Peer Dataflow, *17th IEEE International Symposium on High Performance Distributed Computing* (HPDC), Boston, MA, June 2008.
29. Jinoh Kim, Abhishek Chandra and **Jon B. Weissman**, Accessibility-based Resource Selection in Loosely-coupled Distributed Systems, *28th IEEE International Conference on Distributed Computing Systems* (ICDCS), Beijing, China, June 2008.
30. Krishnaveni Budati, Abhishek Chandra, and **Jon B. Weissman**, RIDGE: Combining Reliability and Performance in Open Grid Platforms, *16th IEEE International Symposium on High Performance Distributed Computing* (HPDC), June 2007.
31. Jason D. Sonnek, Mukesh Nathan, Abhishek Chandra, and **Jon B. Weissman**, Reputation Based Scheduling on Unreliable Distributed Infrastructures, *The 26th International Conference on Distributed Computing Systems* (ICDCS), July 2006.
32. Darin England, Jayashree Sadagopan, and **Jon B. Weissman**, A New Metric for Robustness with Application to Job Scheduling, *Fourteenth IEEE International Symposium on High Performance Distributed Computing* (HPDC), 2005.
33. **Jon B. Weissman** and Xin Zhao, "Run-time Support for Scheduling Parallel Applications in Heterogeneous NOWs," *Proceedings of the Sixth IEEE International Symposium on High Performance Distributed Computing* (HPDC), August 1997.
34. **Jon B. Weissman** and Andrew S. Grimshaw, "A Federated Model for Scheduling in Wide-Area Systems," *Proceedings of the Fifth IEEE International Symposium on High Performance Distributed Computing* (HPDC), August 1996.

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36. Albert Jonathan, Abhishek Chandra, and **Jon Weissman**, Locality-Aware Load Sharing in Mobile Cloud Computing *IEEE/ACM International Conference on Utility and Cloud Computing*, 2017.
37. Albert Jonathan, Abhishek Chandra, and **Jon Weissman**, Ensuring Reliability in Geo-Distributed Edge Cloud, *IEEE RWS (Resilience Week)*, Wilmington, Delaware, 2017.
38. Kwangsung Oh, Ajaykrishna Raghavan, Abhishek Chandra and **Jon Weissman**, Redefining Data Locality for Cross-Data Center Storage, *International Workshop on Software-Defined Ecosystems (BigSystem 2015)*, June 2015, Portland, OR.
39. William Myott, Thao Nguyen, Abhishek Chandra, George Karypis, and **Jon B. Weissman**, Opportunities for Data-Driven Cloud-based Mobile Optimization, invited to 2014 *International Conference on Collaboration Technologies and Systems*, Minneapolis, MN, May 2014.
40. Siddharth Ramakrishna, Robert Reutiman, Abhishek Chandra, and **Jon B. Weissman**, Accelerating Distributed Workflows With Edge Resources, *Second International Workshop on Workflow Models, Systems, Services and Applications in the Cloud (CloudFlow)*, Boston MA, May 2013.
41. Mike Cardosa, Anshuman Nangia, Chenyu Wang, Abhishek Chandra and **Jon B. Weissman**, Exploring MapReduce Efficiency with Highly-Distributed Data, *The Second International Workshop on MapReduce and its Applications (MapReduce '11)*, June 2011.
42. Pradeep Sundarrajan, Abhishek Gupta, Matthew Ryden, Rohit Nair, Abhishek Chandra, and **Jon B. Weissman**, Early Experience with the Distributed Nebula Cloud, *The Fourth International Workshop on Data Intensive Distributed Computing (DIDC '11)*, June 2011.
43. Shantenu Jha, Daniel S. Katz, Manish Parashar, Omer Rana, and **Jon B. Weissman**, Critical Perspectives on Large-Scale Distributed Applications and Production Grids, *10th IEEE/ACM Conference on Grid Computing (Grid 2009)*, Banff, Canada, 2009, winner best paper award.
44. Adam Barker, Paolo Besanay, David Robertson, and **Jon B. Weissman**, The Benefits Of Service Choreography For Data-Intensive Computing, *Proceedings of the 2009 Workshop in Challenges of Large Applications in Distributed Environments (CLADE)*, 2009.
45. Adam Barker, **Jon B. Weissman** and Jano van Hemert, Orchestrating Data-centric Workflows, *IEEE/ACM CCGrid International Symposium on Cluster Computing and the Grid (CCGrid)*, Lyon, France, May 2008.
46. Vasumathi Sundaram, Abhishek Chandra and **Jon B. Weissman**, Exploring the Throughput-Fairness Tradeoff of Deadline Scheduling in Heterogeneous Computing Environments, *Proceedings of the ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, short paper, Annapolis, MD, June 2008.
47. Krishnaveni Budati, Jinoh Kim, Abhishek Chandra and **Jon Weissman**, NGS: Service Adaptation in Open Grid Platforms, *Proceedings of the IPDPS NSF Next Generation Software Workshop*, March 2007.
48. **Jon B. Weissman**, Vipin Kumar, Varun Chandola, Eric Eilertson, Levent Ertoz, Gyorgy Simon, Seonho Kim, and Jinoh Kim, DDDAS/ITR: A Data Mining and Exploration Middleware for Grid and Distributed Computing, *Workshop on Dynamic Data Driven Application Systems - DDDAS 2007*, Beijing, China, May 2007.
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50. **Jon B. Weissman**, Seonho Kim, and Darin England, A Framework for Dynamic Service Adaptation in the Grid, *Proceedings of the IPDPS NSF Next Generation Software Workshop Denver*, Colorado, April 2005.
51. Jason D. Sonnek and **Jon B. Weissman**, A Quantitative Comparison of Reputation Systems in the Grid, *6th IEEE/ACM International Workshop on Grid Computing (GRID)*.

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53. Darin England and **Jon B. Weissman**, "A Stochastic Control Model for the Deployment of Dynamic Grid Services", *5th IEEE/ACM International Workshop on Grid Computing (GRID)*, 2004.
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55. Seonho Kim and **Jon B. Weissman**, "A GA-based approach for scheduling decomposable data grid applications," *International Conference on Parallel Processing (ICPP)* 2004.
56. Byoung-Dai Lee and **Jon B. Weissman**, "Adaptive Resource Selection for Grid-enabled Network Services," *IEEE 2nd International Symposium on Network Computing and Applications (NCA)*, 2003.
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69. Richard Weatherly, David Seidel, and **Jon B. Weissman**, "Aggregate Level Simulation Protocol," *Proceedings of the 1991 Summer Computer Simulation Conference*, July 1991.
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12. Andrew Grimshaw, **Jon B. Weissman**, and Emily A. West, "Experiences with the Mentat Metasystems Testbed," *1992 Workshop on Cluster Computing*, December 1992, extended abstract.

Technical Reports and Other Papers

1. Mitch Terrell, Yixuan Wang, Matt Dorow, Soumya Agrawal, Bhaargav Sriraman, Zach Leidall, Abhishek Chandra, **Jon Weissman**, Constellation: An Edge-Based Semantic Runtime System for Internet of Things Applications, *arXiv:2201.12394*, 2022.
2. Lei Huang, Zhiying Liang, Nikhil Sreekumar, Sumanth Kaushik Vishwanath, Cody Perakslis, Abhishek Chandra, and **Jon Weissman**, Armada: A Robust Latency-Sensitive Edge Cloud in Heterogeneous Edge-Dense Environments, *arXiv:2111.12002*, 2021.
3. Aravind Alagiri Ramkumar, Rohit Sindhu, and **Jon Weissman**, Constellation Plan B Report, University of Minnesota Computer Science TR-20-001, January 2020.
4. Ajaykrishna Raghavan, Abhishek Chandra, and **Jon B. Weissman**, Tiera: Towards Flexible Multi-Tiered Cloud Storage Instances, University of Minnesota Computer Science TR-14-003, January 2014.
5. Mathew Ryden, Abhishek Chandra, and **Jon Weissman**, Nebula: Data Intensive Computing over Widely Distributed Voluntary Resources, University of Minnesota Computer Science TR-13-07, March 2013.
6. Chonglei Mei, Daniel Taylor, Chenyu Wang, Abhishek Chandra, and **Jon B. Weissman**, Mobilizing the Cloud: Enabling Multi-User Mobile Outsourcing in the Cloud, University of Minnesota Computer Science TR-11-029, November 2011.
7. Dan Katz, Shantenu Jha, Manish Parashar, Omer Rana, and **Jon Weissman**, Analysis of Production Distributed Computing Infrastructures, Technical Report CI-TR-7-0811. Computation Institute, University of Chicago & Argonne National Laboratory, September 2011.
8. Chonglei Mei, James Shimek, Chenyu Wang, Abhishek Chandra and **Jon Weissman**, Dynamic Outsourcing Mobile Computation to the Cloud, University of Minnesota Computer Science TR-11-006, March 2011.
9. Louis-Claude Canon, Emmanuel Jeannot, and **Jon B. Weissman**, A Scheduling Algorithm for Defeating Collusion, INRIA, Research Report RR-7403, Oct. 2010.
10. Siddharth Ramakrishnan, Robert Reutiman, Abhishek Chandra, and **Jon B. Weissman**, Standing on the Shoulders of Others: Using Proxies to Opportunistically Boost Distributed Applications, University of Minnesota Computer Science TR-10-012, 2010.
11. Siddharth Ramakrishnan, Robert Reutiman, Harlan Iverson, Shimin Lian, Abhishek Chandra, and **Jon B. Weissman**, Early Experience with Mobile Computation Outsourcing, University of Minnesota Computer Science TR-10-020, 2010.
12. Vasumathi Sundaram, Abhishek Chandra, **Jon B. Weissman**, Exploring the Throughput-Fairness Tradeoff of Deadline Scheduling in Heterogeneous Computing Environments, University of Minnesota Computer Science TR-08-003, 2008.
13. Jinoh Kim, Abhishek Chandra, and **Jon B. Weissman**, OPEN: Passive Network Performance Estimation for Data-intensive Applications, University of Minnesota Computer Science TR-08-041, 2008.
14. Seonho Kim, Jinoh Kim, and **Jon B. Weissman**, A Security-Enabled Grid Middleware for Distributed Data Mining, University of Minnesota Computer Science TR-07-001, 2007.
15. Abhishek Chandra, Rahul Trivedi, and **Jon B. Weissman**, Hosting Services on the Grid: Challenges and Opportunities, University of Minnesota Computer Science TR-05-026, 2005.
16. Lakshman Abburi Rao, **Jon B. Weissman**, MPI-based Adaptive Parallel Grid Services, University of Minnesota Computer Science TR-03-032, 2003.
17. **Jon B. Weissman**, "The Virtual Data Grid: Just-in-time Data Delivery and Data Production for HPC Applications", DOD High Performance Computing Modernization Program Success Story Book, 2002.
18. **Jon B. Weissman**, "Metacomputing Research at the AHPCRC", AHPCRC Bulletin, 2002.

19. **Jon B. Weissman** and Colin Gan, "The Virtual Data Grid: An Infrastructure to Support Distributed Data-Centric Applications," *DOD High Performance Computing Modernization Conference Program* (Users Group Conference 2002), June 2002.
20. **Jon B. Weissman**, "Grids in the Classroom," *IEEE Concurrency*, education feature, July 2000.

CURRENT SOFTWARE

1. Wiera: A cloud-storage infrastructure that provides geo-distributed storage containers across data-centers. (open-sourced)
2. Armada: An edge-cloud system that provides storage and compute services across edge nodes. (open-sourced: in progress)
3. Jingle: An Edge Resource Management System (in progress)
4. DenseIoT: An IoT middleware system. (in progress)

SABBATICALS

1. University of Edinburgh/National e-Science Centre, 2007-2008.

INVITED TALKS

(keynotes in bold)

1. Cloud Data Centers & Edge (CDCE) Workshop UMN, CRIS, Edge Computing Infrastructure, 2021.
2. Media, WCCO Radio Live Interview, Can the Internet Withstand Covid-19?, March 20, 2020.
3. Invited Talk, Hamline University, What does the future of the Internet Hold?, March 2019.
4. Invited Talk, IUCRC Meeting, talk title: Geo-distributed Cloud Storage, May 2017.
5. Invited **Inaugural Keynote**, Open Cloud Institute, University of Texas at San Antonio, talk title: Geo-Distributed Clouds, September 2015.
6. Invited Talk, NITRD MAGIC, talk title: AIMES: Abstractions and Integrated Middleware For Extreme-Scale Science, March 2015.
7. Invited Talk, Inria-ENS, Lyon, France, talk title: Job Shaping on the Cloud, July 2014.
8. Invited Talk, 2014 International Conference on Collaboration Technologies and Systems (CTS 2014), talk title: Opportunities for Data-Driven Cloud-based Mobile Optimization, May 2014.
9. Invited **Keynote**, NSF/ARL Workshop on Cloud Robotics: Challenges and Opportunities, Drexel University, Feb 2013.
10. Invited Panelist, HPDC, The Value of HPDC, June 2012.
11. Invited Talk, CMU, talk title: Extending Mobile Devices into the Cloud, 2012.
12. Invited Talk, Inria-PGH, talk title: TBD, June 2012.
13. Invited Talk, NSF US-China Workshop on Collaborative Software Research, talk title: TBD, 2012.
14. Invited Talk, Thomson-Reuters Inc, talk title: A Tour of MapReduce/Hadoop, 2012.
15. Invited Talk, Adventium Labs Inc, talk title: Minnesota Cloud Research, November 2011.
16. Invited Talk, Georgia Tech (Open Cirrus Summit), talk title: Expanding the Horizons of Cloud Computing Beyond the Data Center, October 2011.
17. Invited Talk, UMN CS Colloquium, talk title: Scheduling Edge Resources to Build Better Distributed Systems, October 2011.
18. Invited **Keynote**, The Fourth International Workshop on Data Intensive Distributed Computing (DIDC 2011), San Jose, California, talk title: Wide-Area Clouds, 2011.
19. Invited Talk, Microsoft, Cloud Futures Workshop, talk title: Expanding the Horizons of Cloud Computing Beyond the Data Center, June 2011.
20. Invited Talk, Inria-Grenoble, Grenoble, France, talk title: Cloud Computing Using Edge Resources, May 2011.
21. Invited Talk, Inria-sponsored Workshop Scheduling for Large Scale systems, Aussois, France, talk title: Scheduling in the Cloud, May 2011.
22. Invited Talk, UMN CS Colloquium, talk title: Cloud Computing: Research Perspectives, April 2011.
23. Invited Talk, University of Minnesota, Science & Engineering Day, talk title: Charting the Cloud Landscape, March 2011.
24. Invited Talk, NSF Workshop: The Science of Cloud Computing, talk title: Minnesota Cloud Research Vision, March 2011.
25. Invited Talk, University of Edinburgh, Informatics/CS, talk title: New Cloud Models for Distributed Dynamic Data-Intensive Programming Application Systems, November 2010.

26. Invited Talk, Inria-sponsored Workshop: Scheduling for Large Scale systems, Aussois, France, talk title: Living on the Edge: Scheduling Edge Resources Across the Cloud, May 2010.
27. Invited Talk, UMn IT Dean Series, talk title: CloudSystems@UMn, April 2010.
28. Invited Talk, Louisiana State University, talk title: Living on the Edge: Broadening the Vision of Cloud Computing, Baton Rouge, Louisiana, March 2010.
29. Invited **Keynote**, Third Workshop on Desktop Grids and Volunteer Computing Systems (PCGrid), Rome, Italy, talk title: Cloud@Grid, 2009.
30. Invited Talk, University of Florida, Workshop on Data Mining for Biomedical Applications, talk title: Communication is Key to a Happy Marriage-Linking Biomedical Applications and the Open Grid, September 2008.
31. Invited Talk, Sabbatical lecture: University of Edinburgh, Informatics/CS, talk title: Grid Computing for E-Science, July 2008.
32. Invited Talk, University of Edinburgh, Informatics/CS, Edinburgh, talk title: Challenges in Reliable Grid Computing, July 2008.
33. Invited Talk, CLADE Workshop, Boston, MA, talk title: Scalable Computing on Open Distributed Systems, June 2008.
34. Invited **Keynote**, ASCI conference, Delft, Netherlands, talk title: Challenges in Reliable Grid Computing, June 2008.
35. Invited Talk, NeSC Science Advisory Board, talk title: Grid Computing for E-Science, May 2008.
36. Invited Talk, University of Edinburgh, Informatics/CS, NeSC Research Seminar, talk title: Harnessing Volunteer Grids, September 2007.
37. Invited Talk, University of Edinburgh, E-Science Institute Public Lecture: talk title: Decentralizing Grids, November 2007.
38. Invited Talk: Vrije University, Amsterdam, Netherlands, talk title: The Dynamic Grid, November 2007.
39. Invited Talk, University of Edinburgh, Informatics/CS, talk title: Achieving Reliability in Open Grids, April 2007.
40. Invited Talk, University of Chicago, talk title: Achieving Reliability in Open Grids, March 2007.
41. Invited Talk, Vrije University, Amsterdam, Netherlands, talk title: Trust-Sensitive Scheduling on the Open Grid, March 2006.
42. Invited Education Talk, UMn Institute of Technology, talk title: Recruiting Workshop talk, Winter 2006.
43. Invited Talk, Inria/NSF-sponsored Workshop: Scheduling for Large Scale distributed platforms, San Diego, California, talk title: Scheduling Challenges in Hosting Services on the Public Grid, 2005.
44. Invited Education Talk, University of Wisconsin, Eau Claire, talk title: Graduate Studies in Computer Science at the "U", 2005.
45. Invited Talk, DOE-ANL, talk title: Future Technology Challenges for Collaboration: Customizing the Grid, 2004.
46. Invited Talk, Inria/NSF-sponsored Workshop: Scheduling for Large-Scale Distributed Platforms, Aussois, France, talk title: Robust Grid Scheduling, 2004.
47. Invited Talk, Digital Technology Center, Open House, talk title: Emerging Technologies: Grid Computing, 2003.
48. Invited Talk, Minnesota IT Leadership Forum, Minneapolis, MN, talk title: Emerging Technology: Grid Computing, October 2002.

49. Invited Talk, Digital Technology Center, Grid Computing: Collaborative Opportunities within the DTC, December 2002.
50. Invited demonstration, HPDC, title: Community Services Project, July 2002.
51. Invited Talk, University of Indiana, Argonne National Laboratory/University of Chicago, talk title: Community Services: Putting High-end Network Services On-line, University of Tennessee, University of Minnesota, 2002.
52. Invited Talk, Dagstuhl Seminar on Management of Metacomputers, Saarbrücken, Germany, talk title: Scheduling Computational Grids: A Five-Year Retrospective, June 2001.
53. Invited Talk, UMN CS Colloquium, talk title: Turning Hype into Reality: Achieving High Performance in a Computational Grid, Fall 1999.
54. Invited Talk, North Carolina State University, Virginia Polytechnic Institute, Northwestern, Indiana University, University of Kentucky, University of Oregon, talk title: Smart File Objects, Spring 1999.
55. Invited Talk, Southwest Research Institute, San Antonio, TX, talk title: Metacomputing Systems and Tools, 1998.
56. Invited Talk, Southwest Research Institute, San Antonio, TX, talk title: Tools for Application Scheduling in Parallel and Distributed Systems, 1997.
57. Invited Talk, UT San Antonio Seminar, talk title: A Survey of Wide-Area File Systems: Issues, Challenges, and Solutions, 1997.
58. Invited Talk, National Cancer Institute, NIH, talk title: Legion: The Next Logical Step Toward a World-Wide Virtual Computer, 1995.
59. Invited Talk, NASA Goddard, talk title: Legion: The Next Logical Step Toward a World-Wide Virtual Computer, 1995.
60. Invited Talk, NASA Jet Propulsion Laboratory, talk title: Scheduling Parallel Computations in a Heterogeneous Environment, 1994.
61. Invited Talk, NASA Jet Propulsion Laboratory, talk title: Multigranular Scheduling of Data Parallel Programs, NASA Jet Propulsion Laboratory, 1993.

TEACHING

Courses Taught

University of Minnesota

- CSci 2021 Machine Organization and Architecture: 2011.
- CSci 8101 Advanced Operating Systems: 2011, 2008, 2007, 2002.
- CSci 4211 Introduction to Computer Networks: 2009.
- CSci 4061 Operating Systems: 2024, 2022, 2020, 2018, 2017, 2016, 2014, 2013, 2012, 2011, 2010, 2006, 2001.
- CSci 8980 Special Topics in Distributed Systems: 2021, 2019, 2017, 2015, 2012, 2004
- CSci 5103 Graduate Operating Systems: 2023, 2021, 2019, 2017, 2015, 2012, 2009, 2000-2005.
- CSci 5105 Introduction to Distributed Systems: 2023, 2020, 2018, 2014, 2013.
- CSci 4131/5131 Internet Programming: 2004, 2001.
- CSci 5980 Special Topics (Metacomputing): 2000.
- CSci xxxx Informal Seminar: Metacomputing: 1999.

STUDENT ADVISING

Ph.D:

- Mitch Terrel, area: Internet of Things, started Fall 2021, past WPE.
- Yixuan Wang, area: Security/Privacy, started Fall 2021.
- Nikhil Sreekumar, area: Edge Storage, started Fall 2019, past WPE.
- Zachary Leidall, area: Internet of Things, (WPE Spring 2019), left program.
- Albert Jonathan *Multi-Tenant Geo-Distributed Analytics*, 2019.
- Kwangsung Oh, *Exploiting Heterogeneous Resources in a Multi-cloud Environment*, 2019.
- Francis Liu, *Elastic Scheduling in HPC Resource Management Systems*, 2019.
- Zachary Leidall, area: Internet of Things, (WPE Spring 2019).
- Jinoh Kim, Ph.D. 2010, *Data Dissemination for Distributed Computing*
Post-doc Lawrence Berkeley Research Lab,
Associate Professor Texas A&M
- Darin England, Ph.D. 2006, *Robust Design for Distributed Computing Systems*, Assistant Teaching Professor,
University of Minnesota.
- Byoung-Dai Lee, Ph.D. 2003, *Adaptive Middleware for High-End Network Services*
Assistant Professor at Kyonggi University, South Korea.

MS Plan A/B/C:

Graduated:

- Lei Huang, Spring 2021, Plan A
- Saurabh Gupta, Spring 2020, Plan B
- Soumya Agrawal, Spring 2020
- Aravind Alagiri Ramkumar, Spring 2019, Plan B
- Rohit Sinhu, Spring 2019, Plan B
- Albert Jonathan (co-advised Chandra), Fall 2016, Plan B
- Prashant Chaudhary (co-advised Chandra), Spring 2015, Plan B
- Ajaykrishna Raghavan (co-advised Chandra), Spring 2014, Plan B
- Mathew Ryden (co-advised Chandra), Spring 2013, Plan B
- Chenyu Wang (co-advised Chandra), Spring 2012, Plan A
- Atul Katiyar, Spring 2010, Plan B
- Siddarth Ramakrishnan, Spring 2010, Plan B
- Omer Jilani, Summer 2009, Plan A-Edinburgh
- Vasumathi Sundaram, Summer 2008, Plan B
- Krishnaveni Budati, Summer 2007, Plan B

- Rahul Trivedi, Fall 2006, Plan B
- Jayashree Sadagopan, Summer 2005, Plan B
- Jason Sonnek, Summer 2005, Plan B
- Anusha Iyer, Spring 2004, Plan B
- Murali Sangubhatla, Summer 2003, Plan B
- Zhaoxin Ding, Fall 2003, Plan B
- Lakshman Abburi, Fall 2003, Plan B
- Pramod Srinivasan, Summer 2001, Plan B

SERVICE

Professional Service

Leadership

- Steering Committee Chair, HPDC, 2010-to-date
- PC Vice-Chair, IPDPS, St. Petersburg Florida, 2023
- General Chair, HPDC, Minneapolis Minnesota, 2022
- General Chair, HPDC, Phoenix Arizona, 2019
- General Chair, HPDC, Washington D.C., 2017
- Co-Organizer The Science of Cyberinfrastructure: Research, Experience, Applications and Models Workshop, e-Science, 2016.
- Co-Organizer The Science of Cyberinfrastructure: Research, Experience, Applications and Models Workshop, HPDC, 2015.
- General Chair, HPDC, New York City, NY, 2013
- Local Chair, PACT, Minneapolis, MN, 2012
- Panel co-organizer and panelist, Cloud Computing, UMn Open House, 2011.
- Steering Committee Chair, HPDC, 2010-to-date.
- International Liaison Co-Chair, ICDCS, 2011.
- Co-Organizer Cloud panel, ICDCS, 2011.
- Co-Organizer Dynamic Distributed Data Programming Abstractions Workshop, HPDC, 2011.
- Member advisory board, NSF FutureGrid, 2010-to-date.
- Global Program Chair, Europar, 2009.
- Co-Organizer, NSF Workshop on Data Mining for Biomedical Applications, University of Florida, 2008.
- Co-Organizer, Distributed Programming Abstractions Workshop at E-Science Conference, 2008.
- Program Co-Chair, HPDC 2008.
- Session Chair, HPDC: 2007, 1999,
- Session Chair, GRID, 2004.
- Panel organizer, Intelligent Storage Workshop, UMn DTC, 2006.
- Publicity Chair, ICPP, 2004, 2000.
- Co-Organizer, Intelligent Storage Workshop, UMn DTC, 2004.
- Co-Organizer, Data Mining and the Grid Workshop, UMn MSI, 2003.
- Exhibits and Poster Chair, HPDC, 2003.
- Program Vice-Chair, ICPP, 2002.
- Tutorial Chair, HPDC: 2001, 2000.
- Session Chair, IPDPS 2000.

Program Committee Member

- The International ACM Workshop on Software-Defined Ecosystem (BigSystems), 2015.
- IEEE International Workshop on Cloud Analytics 2014.
- IEEE International Conference on Cloud Engineering (IC2E) 2016, 2015, 2014, 2013.
- IEEE/ACM International Symposium on High Performance Distributed Computing: 2022-1997.
- IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing: 2023, 2018, 2017, 2016, 2015, 2014, 2012, 2011, 2010, 2009, 2007, 2003.
- Europar 2014.
- 2013 IEEE International Conference on Big Data 2013, 2023.
- IEEE International Parallel and Distributed Processing Symposium 2012.
- SC 2012, 2011, 2010, 2009, 2008, 2007, 2006.
- Workshop on Job Scheduling Strategies For Parallel Processing: 2011, 2010, 2007, 2006.
- Workshop on Large-Scale, Volatile Desktop Grids: 2011, 2010, 2009, 2007.
- IEEE International Conference on Grid Computing: 2010, 2009, 2007, 2006, 2005, 2004, 2003, 2002.
- Cluster Computing and the Grid: 2011, 2010, 2009, 2007, 2003.
- Challenges of Large Applications in Distributed Environments: 2010, 2009, 2006, 2005, 2004, 2003.
- International Conference on Parallel Processing: 2009, 2005, 2004, 2003.

- International Conference on Distributed Computing Systems: 2008.
- IEEE International Conference on e-Science and Grid Technologies: 2005.
- IEEE International Conference on Services Computing: 2004.
- Heterogeneous Computing Workshop: 2004, 2003, 2002, 2001, 2000, 1999.
- International Workshop on Active Middleare Services (Autonomic Computing): 2004, 2003, 2002.
- International Workshop on Heterogeneous and Adaptive Computing: 2003.
- International Conference on High Performance Computing: 2002.

Editorships

- Editor HPDC 1992-2012 special issue
- Editorial board: Journal Frontiers in High Performance Computing, current.
- Editorial board: IEEE Transactions on Computers, past.
- Editorial board: IEEE Transactions on Parallel and Distributed Systems, past
- Editorial board: Journal of Parallel and Distributed Computing, past.
- Special issue editor for Grid Computing, Journal of Parallel and Distributed Computing, past.
- Special issue editor for Grid and P2P computing, ACM Sigmetrics newsletter, Performance Evaluation Review, past.
- Technical editor of IEEE TPDS newsletter, past.